ENHANCING THE IONIC CONDUCTIVITY OF PVDF-HFP GEL POLYMER ELECTROLYTE FOR ALKALINE EARTH METAL ION BATTERIES

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The electrolyte is the key component of alkaline earth metal ion batteries and the ionic conductivity of the electrolyte is one of the most important parameters of the battery electrolyte. Gel polymer electrolytes (GPEs) offer unique advantages by overcoming the limitations associated with both liquid and solid electrolytes, while retaining desirable properties from each type. The present study aimed to synthesize and characterize poly (vinylidene fluoride-co-hexafluoropropylene) (PVDF-HFP) based gel polymer electrolyte in order to improve the conductivity of GPEs. Further, to enhance the ionic conductivity of the PVDF-HFP based GPE, appropriate amount of $MgCl_2$ and of $CaCl_2$ has been incorporated in the electrolyte separately.15% Mg^{2+} incorporated PVDF-HFP electrolyte shows higher ionic conductivity of 3.3060×10^{-3} S cm^{-1} that of 15% Ca^{2+} is 2.1141×10^{-3} S cm^{-1}. The ionic conductivity of GPEs further enhanced by adding TiO_2 nanoparticles as nanofillers. PVDF-HFP+15% Mg^{2+} with 0.075% TiO_2 electrolyte exhibits greater ionic conductivity of 4.3307×10^{-3} S cm^{-1} while PVDF-HFP+15% Ca^{2+} with 0.05% TiO_2 electrolyte shows ionic conductivity of 3.0594×10^{-3} S cm^{-1}.The variation of ionic conductivity with temperature ranging from 25°C to 60°C of the PVDF-HFP+15% Mg^{2+} electrolyte and of PVDF-HFP+15% Ca^{2+} electrolyte was analyzed and the activation energy of each electrolyte was then obtained. The activation energy of the PVDF-HFP+15% Mg^{2+} electrolyte and PVDF-HFP+15% Ca^{2+} electrolyte was found to be 0.71059×10^{-4} eV and 1.43454×10^{-4} eV respectively. This study implies that PVDF-HFP based gel electrolyte can be a suitable candidate for the alkaline earth metal ion batteries.

***Keywords**: Alkaline earth metal ion batteries, Gel polymer electrolyte, Nanofiller, Poly vinylidene fluoride-co-hexafluoropropylene (PVDF-HFP).*